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Why Shops Close Again: An Evolutionary Perspective on the Deregulation of Shopping Hours

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Abstract

This paper introduces a new perspective on the deregulation of shopping hours based on ideas from evolutionary game theory. We study a retail economy where shopping hours have been deregulated recently. It is argued that first, the deregulation leads to a coordination problem between store owners and customer, and second, the ‘solution’ to this problem depends on the specific cost structure of stores and the preferences of customers. In particular, it may happen that, even if it is profitable for both to keep stores open at night, they do not succeed in coordinating on this equilibrium. The analysis explains the observation in Germany, where shopping hours have been deregulated recently, that store owners tend to go back to the former shopping hours again. Moreover, it emphasizes the important role of advertisement campaigns as a signalling device.

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“It is, perhaps, worth stressing that economic problems arise always and only in consequence of change. As long as things continue as before, or at least as they were expected to, there arise no new problems requiring a decision, no need to form a new plan.”

— F.A. Hayek (1948)

1 Introduction

Since November 1, 1996 shopping hours in Germany are deregulated, at least partly. Stores are allowed to open a bit earlier in the morning and to keep open for a longer time period the evening. Yet, shopping hours are far from being liberalized, since in general the policy to restrict opening times has not been abandoned. Therefore the situation is still similar to most other European countries imposing strong restrictions on shopping hours.¹ However, the ‘German experiment’ (Austria has pursued a similar deregulation as well) seems important since the issue of deregulation, especially with respect to shopping hours, is one of the key issues in European economic policy. An investigation of the German experience is therefore not only an interesting project but a necessary undertaking both for theorists and applied economists.

So what do we observe? Although the experience with the new time schedule is, of course, rather short, one of the major phenomena that can already be noticed is that many store owners who initially have started to keep open for an additional period of time, are already going back to the old time schedule again. A recent poll by the *Hauptverband des Deutschen Einzelhandels* (HDE) shows that there is a decline of more than 20% in the number of retailers that decide to stay open. Among small stores, i.e. those having five employees or less, the decline amounts even to more than 30% (HDE, 1997).

Does this say that it is not profitable at all for these stores to stay open for a longer time? Given their experiences the first answer might seem to be, YES. However this paper argues that the answer can also be NO! Even if it is profitable both for a store owner and his customers to keep open at night it might be the case that they do not succeed in attaining this situation. The reason is simply that they are not be able to coordinate on the new equilibrium.

In the following it is shown that first, the deregulation of shopping hours leads to a coordination problem between store owners and customers, and second, the ‘solution’ to this problem in the sense, on which equilibrium do agents coordinate most likely, depends on the specific cost structure of stores and the preferences of their customers. Roughly said, if the conditions are such that the new equilibrium, where stores are open for a longer time and consumers shop late, is risk-dominated by the old equilibrium in the sense of Harsanyi and Selten (1988), then

¹Exceptions are, e.g., Portugal, Sweden and the UK.

the economy will eventually tend back to the old shopping hour schedule again, even if the new schedule Pareto-dominates the old one. The result is based on an evolutionary approach, where agents in the economy continuously adjust their behavior to the environment they interact with. Interaction is restricted to local neighborhoods, which seems realistic since people regularly shop only at a small number of stores and there is a considerable overlap between different stores and different consumers.

To the best of our knowledge, an evolutionary perspective on the deregulation of shopping hours has not yet been given in the economic literature. In most cases the discussion is restricted to a pure equilibrium welfare analysis. It is argued, for example, that regulations favour small shops, while deregulations favor large shops (Clemenzen, 1990; Morrison and Newman, 1983); that deregulations may lead to a general decrease in prices (Clemenzen, 1990), or rather to a decrease at small stores and an increase at large stores (Tanguy et al., 1995). Other articles comparing social benefits and social losses of a deregulation include de Meza (1984), Moorhouse (1984), Kay and Morris (1987), Clemenzen (1994), and Ferris (1994). A recent paper that rationalizes the observation that many German consumers seem to oppose a deregulation of shopping hours is Thum and Weichenrieder (1997).

All this important work ignores the question whether it is at all possible to attain the new equilibrium. However, a deregulation is one of the key examples, where an economy is pushed out of one state, evolves, and possibly finds a new stable or unstable state. An economic discussion of deregulation should therefore include an evolutionary approach focusing on this question. Here lies the contribution of our paper.

The paper is organized as follows. Section 2 presents a basic model for analyzing the strategic situation after the deregulation has taken place. Section 3 studies the evolution of the economy as a result from individual strategy adjustment of agents. Section 4 concludes.

2 A Basic Model

Consider a simple economy, consisting only of two types of economic agents, i.e. retail stores and consumers. Let X denote the set of consumers and Y denote the set of stores. For the sake of simplicity and technical tractability we assume that all consumers are identical with respect to their shopping preferences. Stores face the same technology, in the sense of revenue and cost structure. This does not necessarily mean that consumers and stores are fully identical among each other. Concerning consumers, e.g., this assumption has rather to be interpreted as looking only at one specific type of consumers, say employees for example. The same holds for stores, in the sense that all stores shall be of the same type, say for example medium-size supermarkets. Future versions of the model will have to relax this assumption and look at more heterogeneous agents.

We consider a spatial model of local interaction. Stores and consumers are located on the two-dimensional integer lattice \mathbb{Z}^2 . Precisely, we assume $X \cup Y = \mathbb{Z}^2$, so agents are identified with their location and every location is occupied by exactly one agent. Thus, the number of agents in this model is countably infinite, which allows us to ignore boundary and all other finite population effects in a very convenient way. The distribution of agents among locations is as follows. For agent $z \in \mathbb{Z}^2$ let $N(z) := \{z' \mid |z' - z| = 1\}$ denote the set of locations that have Euclidean distance equal to 1. Stores and consumers are now distributed such that first, for every store $y \in Y$, $N(y)$ is a set of consumers. These are the consumers that buy at store y . Second, for every consumer $x \in X$, $N(x)$ is a set of stores, namely those stores where x purchases his goods. How does this structure look like? Imagine the space \mathbb{Z}^2 to be drawn like a chess board. Then every black square represents a consumer and every white square represents a store. See Figure 1. Clearly, we do not claim this structure to be in any way a literal representation of reality. This is not the point we want to make anyway. Instead, the structure shall give a reasonable ‘playground’ for analyzing the interaction between stores and consumers in a rather tractable way.

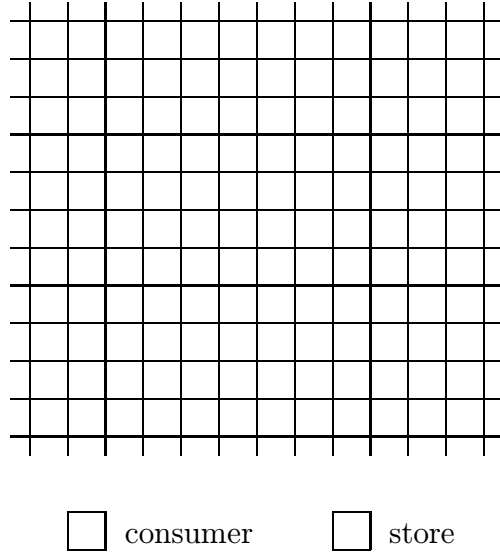


Figure 1: A simple economy

Similar to the economic situation in Germany before November 1, 1996, at the beginning shopping hours are regulated in our model. Stores close early and consumers have adapted to this schedule. Stores make a profit π and consumers earn a utility from shopping that is given by u . Suppose now that the government decides to deregulate existing shopping hours. From now on every store is allowed to keep open for an additional period of time in the evening and, say, on Saturday afternoon.

Then, every economic agent has to decide between two possibilities. A store can either decide to keep *open* in the evening/Saturday afternoon, this strategy is denoted as O , or to *close* at the usual time as under the former regulation. The latter strategy is denoted as C . A consumer can either make *use* of the extended shopping hours, which is denoted as U , or *don't* make use of the liberalization and stick to the former time schedule, denoted as D .

Every consumer x who decides to make use of the extended shopping hours is assumed to do this as follows. He first chooses one store $y \in N(x)$ at random. This choice shall be uniformly distributed.² So any store is selected with probability $\frac{1}{4}$. He then visits this shop in the evening and buys something if the store is in fact open, which gives him positive extra utility $w > 0$. However, if the store is closed this creates frustration and costs him a disutility of $e > 0$. Both values are assumed to include real costs for driving, cycling or going to the shop. It should be expected, of course, that depending on the type of customer values for w and e can vary a lot. An employee, for example, can be thought of having a rather large w and a rather small e , because of inflexible working hours but low costs of mobility. In contrast, a househusband may have more flexibility in his time schedule but rather high costs of mobility. In consequence, he can be expected to have a small w but a large e . A consumer who decides not to make use of the deregulation receives the same utility as under the former regulation which is equal to u .

Every store y who decides to keep open faces additional costs

$$cq + d$$

and additional revenues

$$pq,$$

where c captures variable costs, d gives the amount of fixed costs and p is the average price of goods that are sold at that store.³ The variable q gives the expected numbers of late-shopping customers that come to that specific store. It can take values within the set $\{0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1\}$, depending on how many customers actually choose to shop in the evening. For instance, if all customers decide to go shopping in the evening, since everybody selects that store with probability $\frac{1}{4}$ the expected number of customers that come to that store is equal to 1. If the store decides to close at the same time as before he makes his former profit equal to π .

Let $\xi : X \cup Y \rightarrow \{U, D\} \cup \{O, C\}$ denote the collection of decisions of all agents in the economy. Denote ξ_{-z} the collection of choices of all agents other than agent z . Let $\pi_y(s_y, \xi_{-y})$ be the expected profit of store y who decides on alternative $s_y \in \{O, C\}$ given the rest of the economy behaves according to ξ_{-y} . Similarly denote $u_x(s_x, \xi_{-x})$ the expected utility of

²This assumes that the consumer is not able to let his choice depend on the strategies that each of his neighboring stores plays. For example, he cannot choose a particular store that has decided to stay open. The reason is simply that he does not know this before he has to choose a particular store.

³For a justification of a linear cost structure in the retail sector see Nooteboom (1982).

consumer x who chooses $s_x \in \{U, D\}$ given ξ_{-x} . Then the assumptions made up to now can be expressed as follows.⁴

$$\pi_y(O, \xi_{-y}) = \pi - d + \frac{p-c}{4}N_y(U), \quad (1)$$

$$\pi_y(C, \xi_{-y}) = \pi, \quad (2)$$

$$u_x(U, \xi_{-x}) = u + \frac{w}{4}N_x(O) - \frac{e}{4}N_x(C), \quad (3)$$

$$u_x(D, \xi_{-x}) = u, \quad (4)$$

where $N_y(s)$ gives the number of customers of store y that decide for $s \in \{U, D\}$. Analogously, $N_x(s)$ gives the number of those stores where consumer x shops, that choose $s \in \{O, C\}$.

We assume that additional profits for stores are strictly increasing in the expected number of late-shopping customers and that they are strictly positive if q equals 1. Precisely, if we denote

$$F(q) = -d + (p - c)q,$$

where $q = \frac{1}{4}N_y(U)$, we assume that $p > c$, $F(0) < 0$ and $F(1) > 0$. This means that, similarly to the consumer case, there are positive profits to gain for each store if only enough agents in the economy adapt to the new time schedule.

For the sake of completeness, let us restate that expected additional utility of consumer x is strictly increasing in the number of stores that are open in the evening. If we denote

$$G(n) = wn - e(1 - n),$$

where $n = \frac{1}{4}N_x(O)$, then $w > 0$, $e > 0$, $G(0) < 0$ and $G(1) > 0$.

The situation just described can be seen as a game that is played between stores and consumers. Each consumer x plays with four stores that are located around him, denoted by $N(x)$. At the same time each of these stores plays again with four consumers that are located around that store, including the former consumer x . The set of strategies for any consumer is given by $\{U, D\}$, the set of strategies for any store is given by $\{O, C\}$. Payoffs are determined by the functions $u_x(s, \xi_{-x})$ and $\pi_y(s, \xi_{-y})$. Of course, payoffs depend only on the strategies of neighbors. Interaction is local.

A strategy profile determines a unique strategy for every agent in the economy. As usual we say that a strategy profile is a (pure)⁵ Nash equilibrium if no single agent in the economy can

⁴To simplify notation, in the following we take s to denote both a consumer's and a store's decision whenever misunderstandings can be ignored.

⁵We restrict attention to pure strategies only.

increase his payoff choosing another strategy given that everybody else in the economy plays according to that profile.

There may exist several Nash equilibria in this situation. Many of them can be heterogeneous, meaning that different agents play different strategies. How many heterogeneous Nash equilibria exist, and if they exist at all, depends on the precise values of the parameters chosen in the payoff functions. Still, there are always two homogenous Nash equilibria. In the first one every agent makes use of the deregulation, i.e. every consumer uses extended shopping hours and every store keeps open. We denote this equilibrium by $E_1 = (U, O)$. In the second one nobody in the economy makes use of the deregulation, i.e. every consumer sticks to the old schedule and every store closes at the usual time. We denote this equilibrium by $E_2 = (D, C)$.

It turns out to be justified to look only at these homogenous Nash equilibria. The reason for this is that any heterogeneous equilibrium will be unstable once we introduce an adaptive dynamic, as we are going to do in the next section. In this sense, the economy faces really a coordination problem: either agents coordinate on equilibrium E_1 or on E_2 .

We would like to have available, also in this general set-up, the criteria for Nash equilibria that are common in 2×2 coordination games. In order to do so we will use the following convention. There is a unique 2×2 coordination game Γ that directly corresponds to the just described strategic situation between stores and consumers in the economy. The game Γ is a game between a single store and a single consumer. The payoffs of this game are such that the following holds. Payoffs in the original situation, that are given by functions $u_x(s, \xi_{-x})$ and $\pi_y(s, \xi_{-y})$, are equal to expected payoffs from randomly matching each agent z , ($z \in X \cup Y$) with a single opponent $z' \in N(z)$ with whom he then plays the game Γ . The random matching is uniformly distributed. Considering equations (1)-(4), it is easy to calculate the payoff matrix of the game Γ . It is given in Figure 2.

	O	C
U	$u + w, \pi + (p - c) - d$	$u - e, \pi$
D	$u, \pi - d$	u, π

Figure 2: The Game Γ

Homogenous Nash equilibria in the original situation correspond to pure Nash equilibria of the game Γ . We say that the homogenous Nash equilibrium in the original situation is *Pareto/risk-dominant*, in the sense of Harsanyi and Selten (1988), if the corresponding Nash equilibrium in the game Γ is Pareto/risk-dominant.

So far, our assumptions ensure that the equilibrium E_1 is the Pareto-dominant equilibrium. Whether it is also risk-dominant depends on the relation between equilibrium and

off-equilibrium payoffs. Precisely, the equilibrium E_1 [E_2] is risk-dominant if

$$w \cdot (p - c - d) > [<] e \cdot d.$$

The risk-dominant equilibrium minimizes the product of corresponding deviation losses. In order to keep things simple, we will consider only two different cases. Recall that all relevant terms are positive.

Case 1 $w > e$ and $(p - c) - d > d$.

Case 2 $w < e$ and $(p - c) - d < d$.

The two cases capture the relation between possible gains and losses in the economy after the deregulation. In case 1 consumers are of a type such that the utility gain from late-shopping at an open store is greater than the costs of arriving at a store that is closed. Stores are of a type where profits from late-selling are greater than the amount of fixed costs for keeping open. In this case equilibrium E_1 is risk-dominant. In case 2 the opposite is true. There, consumers face a rather high cost of arriving at a closed store compared to the possible gains from late-shopping. Stores have greater fixed costs than profits from additional sales in the evening. In this case equilibrium E_2 is risk-dominant. For the rest of this paper we assume that all agents face the same gain-loss-ratio, i.e.

$$\frac{(p - c) - d}{d} = \frac{w}{e}. \quad (5)$$

This simplifying assumption is necessary in order to make use of the evolutionary analysis in the next section. Nevertheless, notice that this assumption is weaker than assuming the game Γ to be symmetric.

3 The Evolving Economy

Before the deregulation takes place the economy is in equilibrium E_2 . In fact, everybody is forced to play that equilibrium because of the existing regulation. Then suddenly, the economy is deregulated and everybody is able to revise his strategy. The basic question is, whether the economy is able to leave the bad equilibrium and eventually reach the efficient equilibrium E_1 ?

Suppose that agents behave in the following way. At the beginning each agent $z \in X \cup Y$ individually decides, independently of other agents, to adapt to the new time schedule, or not. This decision can be determined by a random draw or by some other decision procedure, this does not matter. We simply presume that somehow through individual introspection of each agent the initial state of the economy is determined. Afterwards each agent z adjusts his individual strategy to the local environment he faces, that is given by the collection of decisions in $N(z)$. Suppose that this adjustment looks as follows. If all agents in $N(z)$ locally

coordinate on the same Nash equilibrium, i.e. the play in $N(z)$ is homogenous and z plays a best-response to his neighborhood, then agent z does not switch his strategy. However, if play is heterogeneous the situation implies that necessarily agent z plays a best-response to the choice of some agents $z' \in N(z)$ but at the same time possibly miscoordinates with others. Therefore, with some probability he might switch his strategy, depending on the likelihood of miscoordination and the resulting payoff loss he faces. Suppose that each agent switches his strategy the more likely, the higher the relative payoff gain from that switch is. That is, instead of adjusting to best-responses with probability one, simply *agents adjust to better responses more likely*. Still, they are influenced by payoff differences, which in some sense is also the essence of pure best-response behavior. Yet, while in the latter infinitesimally small payoff differences are weighted in the same way as large payoff differences, it is here assumed that payoff differences matter the more the larger they are.⁶

Formally, let $t = 0$ denote the time when the deregulation of shopping hours comes into effect. We model time being continuous. Denote $\Xi = \{\xi \mid \xi : X \cup Y \rightarrow \{U, D\} \cup \{O, C\}\}$ the set of all possible states of the economy. A state of the economy determines a unique strategy for each agent. Let $\xi^t \in \Xi$ give the state of the economy at time t and $\xi^t(z) \in \{U, D\} \cup \{O, C\}$ the strategy that is played by agent z at time t . Analogously, let $u_x(s, \xi_{-x}^t)$, $s \in \{U, D\}$, and $\pi_y(s, \xi_{-y}^t)$, $s \in \{O, C\}$, denote the expected utilities of consumer x and the expected profits of store y , respectively.

Technically we model individual probabilities to adjust a strategy by so-called flip rates. These rates are real-valued functions and determine the probability for an agent to switch (flip) to the other strategy within an infinitesimally short period of time. Precisely this works as follows. Denote $r_z(s, \xi_{-z}^t) \in [0, \infty)$ the flip rate of agent z given the state where the rest of the economy plays according to ξ_{-z}^t and z plays s . Then for $\delta \downarrow 0$ it holds that

$$\text{Prob}[\xi^{t+\delta}(z) \neq s] = r_z(s, \xi_{-z}^t) \cdot \delta + o(\delta). \quad (6)$$

Thus, for infinitesimally short periods of time the probability for agent z to adjust his strategy within that period from s to the complementary strategy s^C equals the product of the flip rate $r_z(s, \xi_{-z}^t)$ times the length of the time period.

The above described stochastic strategy adjustment is now implemented via the following assumption. For each agent z ,

$$r_z(s, \xi_{-z}^t) - r_z(s^C, \xi_{-z}^t) = v_z(s^C, \xi_z^t) - v_z(s, \xi_{-z}^t), \quad (7)$$

where v_z is equal to the utility function in case z is a consumer and equals the profit function if z is a store. The effect of (7) is indeed that agents adjust towards better strategies more

⁶The described stochastic strategy adjustment is discussed in more detail in Kosfeld (1998). Our results in this model do not depend on this approach. For models that use perturbed best-response behavior as a description of individual adjustment behavior and get the same evolutionary prediction see Ellison (1993) and Blume (1993).

likely. The larger the payoff difference between the other strategy and the current strategy is the more likely it is that the agent adjusts to the other strategy.

Inserting the definition of payoffs in our model (see equations (1)-(4)), differences in (7) can be calculated as follows:

$$u_x(U, \xi_{-x}^t) - u_x(D, \xi_{-x}^t) = \frac{w}{4}N_x(O) - \frac{e}{4}N_x(C) \quad (8)$$

in the case of the consumer, and

$$\pi_y(O, \xi_{-y}^t) - \pi_y(C, \xi_{-y}^t) = \frac{p - c - d}{4}N_y(U) - \frac{d}{4}N_y(D) \quad (9)$$

in the case of a store. Thus, putting equations (7), (8) and (9) together, we obtain

$$r_x(D, \xi_{-x}^t) = \frac{w}{4}N_x(O), \quad (10)$$

$$r_x(U, \xi_{-x}^t) = \frac{e}{4}N_x(C), \quad (11)$$

in the case of consumer x , and

$$r_y(C, \xi_{-y}^t) = \frac{p - c - d}{4}N_y(U), \quad (12)$$

$$r_y(O, \xi_{-y}^t) = \frac{d}{4}N_y(D), \quad (13)$$

in the case of store y .

To get an intuition for these rates consider first a consumer (equations (10) and (11)). The probability to adjust from not using the new shopping hours, D , to using the new schedule, U , depends on the expected gain from using the new schedule, which again depends on number of stores that are open, O , weighted by the utility of shopping late, w . Similarly, the probability to adjust into the other direction depends on how many stores are closed, C , weighted by the disutility of arriving at a closed store, e . The same for the store side (equations (12) and (13)). The probability to adjust from closing as usual, C to opening longer, O depends on the profit that can be gained from opening longer, which depends on the number of customers that use the new shopping schedule, weighted by the respective profit factor. And the probability to adjust from opening longer to closing early depends on how many customers are actually not using the new shopping hours, weighted by fixed costs, d . All these relations are monotone, the more agents behave in the particular way, the higher the probability to adjust the strategy in the respective manner.

Having defined the adaptive behavior of individual agents in the economy, we can now ask again: Where is the economy most likely to settle down if agents start independently choosing their initial strategy and then stochastically adjust to the play in their local environment? The answer is given in the following proposition.

Proposition 1 *Let μ^t denote the distribution of the stochastic process $\{\xi^t\}_{t \geq 0}$ at time t . If the initial state of the economy is completely mixed in the sense that μ^0 -a.s. it contains both infinitely many agents that use the new shopping hours and infinitely many agents that do not, then*

$$\lim_{t \rightarrow \infty} \mu^t = \nu_{rd}, \quad (14)$$

where ν_{rd} is the distribution that puts probability one on the risk-dominant equilibrium.

Proof: The claim follows from results in Kosfeld (1998) that ensure weak convergence to the risk-dominant equilibrium whenever the initial state contains infinitely many agents that play the risk-dominant strategy. Since the initial state is completely mixed the latter is obviously true. \square

Proposition 1 shows that whenever the shares of both types of agents, those that use the new shopping hours and those that do not, have at least some positive measure within the population, how ever small, the economy eventually converges to the risk-dominant equilibrium. Since our model works in the infinite space \mathbf{Z}^2 the criterion is that the number of both types must actually be infinite.⁷ This criterion is easily fulfilled. Suppose that an infinite subset of agents (possibly all, or only all consumers, or only an infinite subset of consumers, ...) randomizes. They flip a coin that says U (or O) with probability $\theta > 0$, and D (or C) with probability $1 - \theta$. This implies that the initial state is completely mixed.

That a complete mix seems also a very realistic assumption to describe the initial behavior in Germany after the deregulation has come into effect, can be seen from a study among consumers conducted by the *Institut für Demoskopie Allensbach* (1996) during the early time period from November 15, until November 23, 1996. There consumers report that 77% of the stores they regularly shop at have indeed changed their opening hours at least partly, while 16% of the stores have not changed their opening times very much. At the same time 44% of the consumers report to have used the new shopping hours already. Altogether, the initial collection of decisions among stores and consumers appears to have been very heterogeneous, which is in accordance with the sufficient condition in Proposition 1.

The answer to the question, whether the economy is able to leave the inefficient equilibrium E_2 and eventually reach the efficient one E_1 therefore simply depends on which equilibrium is risk-dominant.

Corollary 1 *In case 1, where $w > e$ and $(p - c) - d > d$, agents coordinate eventually on the efficient equilibrium E_1 . In case 2, where $w < e$ and $(p - c) - d < d$, agents coordinate on inefficient equilibrium E_2 .*

⁷Every finite translation invariant measure on \mathbf{Z}^2 puts measure zero on finite subsets of \mathbf{Z}^2 .

Thus we obtain a clear result in form of a classical dichotomy. In case 1 the economy can in fact be expected to reach the efficient equilibrium. However, in case 2 it may be that for some time there are some consumers and stores that practice the new time schedule but eventually they will disappear and everybody will go back to the old shopping hour schedule again. The reason for this is that the new equilibrium, even if it is Pareto-dominant, is more risky.

We believe that the situation in Germany very much looks like case 2 rather than like case 1. The reason for this is as follows. On the one side, consumers have become used to go shopping early, because they always had to do so. They have arranged their everyday life with an opening hours schedule for a long time period during the past. Since they are not used to the possibility to shop late they will still do most of their shopping during the former opening hours. Commodities that they might purchase outside the old system will be less important for them. Certainly, people may like to go shopping in the evening. Still, the additional personal gain from that shopping which, in our model, is expressed by the value of w can be expected to be rather small. At least, smaller than the cost of going to the store and facing the risk of standing in front of a closed door, which is captured by the value of e . Because people do their main shopping within the old time system it costs them extra effort to visit a store in the evening. Consequently, the degree of frustration or disutility from arriving at a closed store is very high. Thus, we should expect the inequality to be $w < e$.

On the other side, stores face a high pressure of additional fixed costs. If they decide to stay open, they first have to look for more clerks who they can hire, or they have to convince the employed staff to work longer. Personal investigation and the discussion in Germany tells us that especially the latter is a rather difficult procedure. It can be a very costly one as well, since employees ask for higher wages when working in the evening. In contrast, it is not sure how much additional profit the store will earn from sales in the evening. Even if we consider overall profit to be positive, as it has been done in our model, it is very plausible that at least at the beginning it will not be that high. The reason is again, that consumers are not used to shop outside the old opening hours system. Therefore, they will still do most of their important purchases within the old system. Altogether, also on the store side the inequality is most likely to look like $(p - c) - d < d$.

Thus, if the German economy can in fact be described by case 2, the result in our model gives a precise explanation for why currently many stores and consumers in Germany are tending back to the old shopping hours again. It does not necessarily have to be the case that the new time schedule is less profitable, i.e. additional utility/profit from using the new schedule is negative. It is simply enough that the new schedule is more risky than the old one. This already ensures that agents are very likely to miscoordinate on the old and inefficient equilibrium.

4 Concluding Remarks

The simple model in this paper focuses on the possibility of miscoordination between consumers and stores within an economy where shopping hours have been deregulated recently. Roughly said, the results show that it is most likely for agents to coordinate on the inefficient equilibrium, where everybody goes back to the old shopping hours again, if individual preferences and technologies are such that the other efficient equilibrium is risk-dominated by the inefficient one. In this case interactions between agents form a kind of vicious circle that eventually leads into the trap of the bad equilibrium.

How do policy advices look like that could indicate possible ways out of the trap? An immediate comment is, why don't agents just *signal* their willingness to coordinate on the efficient equilibrium. Although this can be rather complicated and difficult for the consumer side, it is a very easy procedure for stores. They just have to do some advertisement campaigns, announcing, that from now on they are going to stay open for a longer time period. In fact, this is also what can be observed, at least if we look at larger supermarkets or department stores for example.⁸ However, for smaller retail stores such big advertisements may often be too expensive. In consequence, they reduce their signalling to some sort of word-of-mouth communication, hoping that this already provides sufficient information to the consumer side.

The effects of signalling in problems of coordination have been analyzed in different models by Matsui (1991) and Kim and Sobel (1995). The common result is that signalling in the sense of cheap-talk or preplay-communication does in fact lead to efficiency. Having the possibility to announce their willingness to play either this or the other equilibrium agents do no longer coordinate on the risk-dominant but on the Pareto-dominant equilibrium. Consequently, signalling is an important policy advice, in particular for the store side in the economy.

The extent and the form of signalling may of course depend on the specific situation of a store. Large stores or those belonging to a chain of stores may find it easier to advertise because of a better cost-gain relation of such an advertisement campaign. Stores located at the same place together with many other stores, as for instance at large shopping malls or in the centre of a city, may also have an advantage since consumers might already have been attracted by some other stores at that location. This may, however, again lead to an additional coordination problem or even a free-rider problem between different stores, because of positive externalities from advertisement. The precise way and the degree of signalling may thus vary a lot between different kinds of stores.

In any case, it is our impression that the degree of signalling that has been observed after the deregulation in Germany has come into effect indicated that stores have not made use of that

⁸These branches are also the ones where the number of those using the new shopping possibilities have been the highest, and where the recent decline in stores that keep open is the smallest (HDE, 1997).

strategy very extensively.⁹ This might be due to the general situation in Germany, in particular due to many store owners attitude towards customers service. It has often been criticized that the European atmosphere in classical service branches is more or less ‘consumer–evil’ and that stores have not yet noticed their profitable gains from offering more services to their customers. This might be one of the basic reasons for why stores do not see the necessity to signal their willingness to adapt to the new time schedule.

The deregulation of shopping hours and the freedom to choose its own opening schedule offers a new dimension in the space of strategies that are available to individual stores. Using this strategic variable may allow for a much more sensitive response to consumers’ preferences, who then, themselves, are again able to develop a greater variety of individual needs.¹⁰ In consequence, the structure of both the supply and the demand side can evolve very heterogeneously. Some stores will decide to stay open at night, possibly with higher prices, while others close early, thereby being able to offer lower prices. Consumers may sometimes find it easier to shop late, accepting a possibly higher price of commodities. At other instances again they will have the time to shop early and they will go for lower prices. In any case, it should be expected that there will be a coexistence of several types of stores and consumers, instead of only one. For theorists, again, this implies a development of current models in order to capture such an evolution of the economy. The approach given in this paper can be seen as a first step into that direction.

⁹Unfortunately, we are not aware of any data that looks at this issue.

¹⁰This is hardly a new point but has already been the position of Tullock (1975). See also de Meza (1984).

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